

Gualala Watershed Synthesis Report



The mission of the North Coast Watershed Assessment Program is to conserve and improve California's north coast anadromous salmonid populations by conducting, in cooperation with public and private landowners, systematic multi-scale assessments of watershed conditions to determine factors affecting salmonid production and recommend measures for watershed improvements.

DRAFT

References Cited

These references were specifically cited in the body of the report. A complete listing of the data and literature sources used in the watershed assessment is presented in Appendix 4.

California Department of Fish and Game. 1968. Drainage description, discussion of riparian community, climate, soils, fisheries, flow data (1950-1971) in the Gualala and Garcia Rivers. 10pp., maps. California Department of Fish and Game, Region 3, Yountville, CA. (Date of report estimated by Bill Cox).

Coastal Forestlands 1997 Sustained Yield Plan.

CRWQCB. 2001. Gualala River Watershed Technical Support Document for the Total Maximum Daily Load for Sediment. NCRWQCB, Santa Rosa, CA: 132 pp

EIP & Associates. 1994. Gualala Aggregates, Inc., Draft EIR

EIP Associates. 1994. Gualala Aggregates, Inc. Draft Environmental Impact Report. State Clearinghouse No. 92123014. October 1994. Permit and Resource Management Department, Sonoma County, CA. 58 pp.

EIP Associates. 1994. Gualala Aggregates, Inc. Draft Environmental Impact Report. State Clearinghouse No. 92123014. October 1994. Permit and Resource Management Department of Sonoma County, CA.

Higgins, Patrick. 1997. Gualala River Watershed Literature Search and Assimilation. Funded by Coastal Conservancy. Under contract to Redwood Coast Land Conservancy.

Higgins, Patrick. 2001. Gualala River Watershed Literature Search and Assimilation. Revised.

Louisiana Pacific Corporation. 1997. Sustained Yield Plan. Vol. 6. South Coast.

RWQCB. 2000. Review of Russian River Water Quality Objectives for Protection of Salmonid Species Listed Under the Federal Endangered Species Act. Regional Water Quality Control Board, August 18, 2000: 80 pp.

RWQCB. 2001. Methods Manual for Water Quality Data Gathering and Analysis for the North Coast Watershed Assessment Program. N. Coast Regional Water Quality Control Board, Santa Rosa, CA, May 8, 2001 draft: 11pp + 1 attachment + 6 appendices.

Glossary

AGGRADATION: The geologic process by which stream beds, floodplains, and the bottoms of other water bodies are raised in elevation by the deposition of material eroded and transported from other areas. It is the opposite of degradation.

ALEVIN: The life stage of salmonids that occurs after eggs have hatched but before young emerge from the gravel nests where they have incubated. Alevin still have yolk sacs attached to provide them with nutrition within the nest.

ALLUVIUM: A general term for all deposits resulting directly or indirectly from the sediment transport of streams, thus including the sediments laid down in riverbeds, floodplains, lakes, fans and estuaries. *ALLUVIAL adj.*

ANADROMOUS: Fish that leave freshwater and migrate to the ocean to mature then return to freshwater to spawn. Salmon, steelhead and shad are examples.

ANTHROPOGENIC: Caused by humans.

ARCINFO: ESRI (Environmental Systems Research Institute) proprietary software, which provides a complete GIS data creation, update, query, mapping, and analysis system.

AERIAL: Having to do with or done by aircraft. Aerial photographs are taken from aircraft equipped with cameras.

BANKFULL DISCHARGE: The discharge corresponding to the stage at which the floodplain of a particular stream reach begins to be flooded. The point at which bank overflow begins.

BANKFULL WIDTH: The width of the channel at the point at which overbank flooding begins.

BASIN: see watershed.

BED SUBSTRATE: The materials composing the bottom of a stream.

BENTHIC: The collection of organisms living on or in sea, river or lake bottoms.

BOULDER: Stream substrate particle larger than 10 inches (256 millimeters) in diameter.

CALWATER: A set of standardized watershed boundaries for California nested into larger previously standardized watersheds and meeting standardized delineation criteria.

CANOPY: The overhead branches and leaves of stream-side vegetation.

CANOPY COVER: The vegetation that projects over the stream.

CANOPY DENSITY: The percentage of the stream covered by the canopy of plants, sometimes expressed by species.

CENTROID: The center of water mass of a flowing stream at any location. This location usually correlates well with the thalweg, or deepest portion of the stream. Sampling in the centroid is intended to provide a reasonably representative sample of the main stream.

CHANNEL: A natural or artificial waterway of perceptible extent that periodically or continuously contains moving water. It has a definite bed and banks, which serve to confine the water.

COAST RANGE: A string of mountain ranges along the Pacific Coast of North America from Southeastern Alaska to lower California.

COBBLE: Stream substrate particles between 2.5 and 10 inches (64 and 256 millimeters) in diameter.

COLLUVIUM: A general term for loose deposits of soil and rock moved by gravity; e.g. talus.

CONIFEROUS: Any of various mostly needle-leaved or scale-leaved, chiefly evergreen, cone-bearing gymnospermous trees or shrubs such as pines, spruces, and firs.

CONSUMPTIVE USE OF WATER: Occurs when water is taken from a stream and not returned.

COVER: Anything that provides protection from predators or ameliorates adverse conditions of streamflow and/or seasonal changes in metabolic costs. May be Instream cover, turbulence, and/or overhead cover, and may be for the purpose of escape, feeding, hiding, or resting.

DEBRIS: Material scattered about or accumulated by either natural processes or human influences.

DEBRIS JAM: Log jam. Accumulation of logs and other organic debris.

DEBRIS LOADING: The quantity of debris located within a specific reach of stream channel, due to natural processes or human activities.

DECIDUOUS: A [plant](#) (usually a [tree](#) or [shrub](#)) that [sheds](#) its [leaves](#) at the [end](#) of the growing [season](#).

DEGRADATION: The geologic process by which stream beds and floodplains are lowered in elevation by the removal of material. It is the opposite of aggradation.

DEPOSITION: The settlement or accumulation of material out of the water column and onto the streambed. Occurs when the energy of flowing water is unable to support the load of suspended sediment.

DEPTH: The vertical distance from the water surface to the streambed.

DISCHARGE: Volume of water flowing in a given stream at a given place and within a given period of time, usually expressed as cubic meters per second (m³/sec), or cubic feet per second (cfs).

DISSOLVED OXYGEN (DO): The concentration of oxygen dissolved in water, expressed in mg/l or as percent saturation, where saturation is the maximum amount of oxygen that can theoretically be dissolved in water at a given altitude and temperature.

DIVERSION: A temporal removal of surface flow from the channel.

ECOTONE: A transition area between two distinct habitats that contains species from each area, as well as organisms unique to it.

EMBEDDEDNESS: The degree that larger particles (boulders, rubble, or gravel) are surrounded or covered by fine sediment. Usually measured in classes according to percentage of coverage of larger particles by fine sediments.

ECOLOGICAL MANAGEMENT DECISION SUPPORT (EMDS): An application framework for knowledge-based decision support of ecological landscape analysis at any geographic scale.

EMBRYO: An organism in its early stages of development, especially before it has reached a distinctively recognizable form.

ENDANGERED SPECIES: Any species which is in danger of extinction throughout all or a significant portion of its range other than a species of the Class Insecta determined by the Secretary to constitute a pest whose protection under the provisions of this Act would present an overwhelming and overriding risk to man.

EROSION: The group of natural processes, including weathering, dissolution, abrasion, corrosion, and transportation, by which material is worn away from the earth's surface. *EROSIONAL adj.*

ESTUARY: A water passage where the tide meets a river current.

EXTIRPATION: To destroy totally; exterminate.

EXTINCTION: The [death](#) of an [entire species](#).

FILL: a) The localized deposition of material eroded and transported from other areas, resulting in a change in the bed elevation. This is the opposite of scour; b) The deliberate placement of (generally) inorganic materials in a stream, usually along the bank.

FINE SEDIMENT: The fine-grained particles in stream banks and substrate. Those are defined by diameter, varying downward from 0.24 inch (6 millimeters).

FISH HABITAT: The aquatic environment and the immediately surrounding terrestrial environment that, combined, afford the necessary biological and physical support systems required by fish species during various life history stages.

FLATWATERS: In relation to a stream, low velocity pool habitat.

FLOOD: Any flow that exceeds the bankfull capacity of a stream or channel and flows out of the floodplain; greater than bankfull discharge.

FLOODPLAIN: The area bordering a stream over which water spreads when the stream overflows its banks at flood stages.

FLOW: a) The movement of a stream of water and/or other mobile substances from place to place; b) The movement of water, and the moving water itself; c) The volume of water passing a given point per unit of time. Discharge.

FLUVIAL: Relating to or produced by a river or the action of a river. Situated in or near a river or stream.

FRESHETS: A sudden rise or overflowing of a small stream as a result of heavy rains or rapidly melting snow.

FRY: Small fish, especially young, recently hatched fish.

GEOGRAPHIC INFORMATION SYSTEM (GIS): A computer system for capturing, storing, checking, integrating, manipulating, analysing and displaying data related to positions on the Earth's surface. Typically, a GIS is used for handling maps of one kind or another. These might be represented as several different layers where each layer holds data about a particular kind of feature (e.g. roads). Each feature is linked to a position on the graphical image of a map.

GEOMORPHOLOGY: The study of surface forms on the earth and the processes by which these develop.

GRADIENT: The slope of a streambed or hillside. For streams, gradient is quantified as the vertical distance of descent over the horizontal distance the stream travels.

GRAVEL: Substrate particle size between 0.08 and 2.5 inches (2 and 64 millimeters) in diameter.

GRILSE see jack.

GULLY: A deep ditch or channel cut in the earth by running water after a prolonged downpour.

HABITAT: The place where a population lives and its surroundings, both living and nonliving; includes the provision of life requirements such as food and shelter.

HABITAT CONSERVATION PLAN: A document that describes how an agency or landowner will manage their activities to reduce effects on vulnerable species. An HCP discusses the applicant's proposed activities and describes the steps that will be taken to avoid, minimize, or mitigate the "take" of species that are covered by the plan.

HABITAT TYPE A land or aquatic unit, consisting of an aggregation of habitats having equivalent structure, function, and responses to disturbance.

HATCH BOX: An apparatus in which environmental conditions, such as temperature and sediment, can be controlled, used for hatching eggs artificially.

HIERARCHY: A series of ordered groupings of people or things within a system.

HYDROGRAPH: A graph showing, for a given point on a stream, the discharge, stage, velocity, or other property of water with respect to time.

HYDROLOGY: The [science](#) of [water](#), its [properties](#), phenomena, and [distribution](#) over the earth's [surface](#).

HYDROGRAPHIC UNIT: A watershed designation at the level below Hydrologic Region and above Hydrologic Sub-Area.

HYPOTHESIS: A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation.

INCUBATION: Maintaining something at the most favorable temperature for its development.

INSTREAM COVER: Areas of shelter in a stream channel that provide aquatic organisms protection from predators or competitors and/or a place in which to rest and conserve energy due to a reduction in the force of the current.

INTERMITTENT STREAM: A stream in contact with the ground water table that flows only at certain times of the year when the ground water table is high and/or when it receives water from springs or from some surface source such as melting snow in mountainous areas. It ceases to flow above the streambed when losses from evaporation or seepage exceed the available stream flow. Seasonal.

JACK: An immature male salmonid (usually two-year old) that returns to freshwater to spawn. Also known as grilse.

KNOWLEDGE BASE: An organized body of knowledge that provides a formal logical specification for the interpretation of information.

LAGOON: A shallow body of water, especially one separated from a sea by sandbars or coral reefs.

LIMITING FACTOR: Environmental [factor](#) that [limits](#) the [growth](#) or [activities](#) of an [organism](#) or that restricts the [size](#) of a [population](#) or its [geographical range](#).

LARGE WOODY DEBRIS (LWD): A large piece of relatively stable woody material having a diameter greater than 12 inches (30centimeters) and a length greater than 6 feet (2 meters) that intrudes into the stream channel. Large organic debris.

MACROINVERTEBRATE: An invertebrate animal (animal without a backbone) large enough to be seen without magnification.

MAINSTEM: The principal, largest, or dominating stream or channel of any given area or drainage system.

MELANGE: A mappable body of rock that includes fragments and blocks of all sizes, both exotic and native, embedded in a fragmented and generally sheared matrix.

MIGRATION: The periodic passage from one region to another for feeding or breeding.

NETWEAVER: A knowledge-based development system. A meta database that provides a specification for interpreting information.

NUTRIENT: A nourishing substance; food. The term *nutrient* is loosely used to describe a compound that is necessary for metabolism.

ONCORHYNCHUS: A [genus](#) of the [family salmonidae](#) ([salmons](#) and [trouts](#)). They are named for their hooked ([onco](#)) [nose](#) (rhynchus).

ORGANIC DEBRIS: Debris consisting of plant or animal material.

ORTHOPHOTOQUADS: A combined aerial photo and planimetric quad map (with no indication of contour) without image displacements and distortions.

PERMANENT STREAM: A stream that flows continuously throughout the year. Perennial.

pH: A measure of the hydrogen ion activity in a solution, expressed as the negative \log_{10} of hydrogen ion concentration on a scale of 0 (highly acidic) to 14 (highly basic) with a pH of 7 being neutral.

PLATE TETONICS: A theory in which the earth's crust is divided into mobile plates which are in constant motion causing earthquake faults, volcanic eruptions, and uplift of mountain ranges.

PHOTOGRAMMETRY: The process of making maps or scale drawings from photographs, especially aerial photographs.

PRODUCTIVITY: a) Rate of new tissue formation or energy utilization by one or more organisms; b) Capacity or ability of an environmental unit to produce organic material; c) The ability of a population to recruit new members by reproduction.

REDD: A spawning nest made by a fish, especially a salmon or trout.

REFERENCE CONDITIONS: Minimally impaired conditions that provide an estimate of natural variability in biological condition and habitat quality.

RIFFLE: A shallow area extending across a streambed, over which water rushes quickly and is broken into waves by obstructions under the water.

RILL: An erosion channel that typically forms where rainfall and surface runoff is concentrated on slopes. If the channel is larger than one square foot in size, it is called a gully.

RIPARIAN: Pertaining to anything connected with or immediately adjacent to the banks of a stream or other body of water.

RIPARIAN AREA: The area between a stream or other body of water and the adjacent upland identified by soil characteristics and distinctive vegetation. It includes wetlands and those portions of floodplains and valley bottoms that support riparian vegetation.

RIPARIAN VEGETATION: Vegetation growing on or near the banks of a stream or other body of water on soils that exhibit some wetness characteristics during some portion of the growing season.

RUBBLE: Stream substrate particles between 2.5 and 10 inches (64 and 256 millimeters) in diameter.

SALMONID: Fish of the family Salmonidae, including salmon, trout, chars, whitefish, ciscoes, and graylings.

SCOUR: The localized removal of material from the stream bed by flowing water. This is the opposite of fill.

SEDIMENT: Fragmented material that originates from weathering of rocks and decomposition of organic material that is transported by, suspended in, and eventually deposited by water or air, or is accumulated in beds by other natural phenomena.

SERIAL STAGES: The [series](#) of relatively [transitory plant communities](#) that [develop](#) during ecological [succession](#) from [bare ground](#) to the climax [stage](#).

SHEAR: A deformation resulting from stresses that cause contiguous parts of a body to slide relatively to each other in a direction parallel to their plane of contact.

SHEAR STRAIN: A measure of the amount by which parallel lines have been sheared past one another by deformation.

SHEAR ZONE: A tabular zone of rock that has been crushed and brecciated by many parallel fractures due to shear strain.

SILVICULTURE: The care and cultivation of forest trees; forestry.

SMOLT: [Juvenile](#) salmonid one or more [years old](#) that has undergone [physiological](#) changes to cope with a [marine environment](#), the [seaward](#) migration [stage](#) of an [anadromous](#) salmonid.

SMOLTIFICATION: The physiological change adapting young anadromous salmonids for survival in saltwater.

SPAWNING: To produce or deposit eggs.

STADIA RODS: Graduated rods observed through a telescopic instrument while surveying to determine distances and elevation.

STAGE: The elevation of a water surface above or below an established datum or reference.

STRATH: a) An extensive terrace like remnant of a broad valley floor that has undergone dissection; b) A broad valley floor representing a local base level, usually covered by a veneer of alluvium.

STREAM: (includes creeks and rivers): A stream is a body of water that flows at least periodically or intermittently through a bed or channel having banks and supports fish or other aquatic life. This includes watercourses having a surface or subsurface flow that supports or has supported riparian vegetation.

STREAM BANK: The portion of the channel cross section that restricts lateral movement of water at normal water levels. The bank often has a gradient steeper than 45 degrees and exhibits a distinct break in slope from the stream bottom. An obvious change in substrate may be a reliable delineation of the bank.

STREAM CLASSIFICATION: Various systems of grouping or identifying streams possessing similar features according to geomorphic structure (e.g. gradient), water source (e.g.) spring creek), associated biota (e.g. trout zone) or other characteristics.

STREAM CORRIDOR: A stream corridor is usually defined by geomorphic formation, with the corridor occupying the continuous low profile of the valley. The corridor contains a perennial, intermittent, or ephemeral stream and adjacent vegetative fringe.

STREAM REACH A section of a stream between two points.

SUBSTRATE: The material (silt, sand, gravel, cobble, etc.) that forms a stream or lakebed.

SUBWATERSHED: One of the smaller watersheds that combine to form a larger watershed.

TAKE: to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

TERRACE: A former floodplain underlain by sediment deposited by a stream when the stream was flowing at a higher level; typically forming a relatively level bench along a valley side adjacent to a recent floodplain.

TERRAIN: A tract or region of the earth's surface considered as a physical feature, an ecological environment, or a site of some planned activity of man.

TERRANE: A term applied to a rock or group of rocks and to the area in which they crop out. The term is used in a general sense and does not imply a specific rock unit.

THALWEG: The line connecting the lowest or deepest points along a stream bed.

THREATENED SPECIES: any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

TOPOGRAPHY: The general configuration of a land surface, including its relief and the position of its natural and man-made features.

TOPOLOGY: The analytical, detailed study of minor landforms, requiring fairly large scales of mapping.

TRIBUTARY: A stream feeding, joining, or flowing into a larger stream. Feeder stream, side stream.

UNDERCUT BANK: A bank that has had its base cut away by the water action along man-made and natural overhangs in the stream.

VELOCITY: The time rate of motion; the distance traveled divided by the time required to travel that distance.

WATER RIGHT: The right to draw water from a particular source, such as a lake, irrigation canal, or stream. Often used in the plural.

WATERSHED ASSESSMENT: An interdisciplinary process of information collection and analysis that characterizes current watershed conditions at a course scale.

WATERSHED: Total land area draining to any point in a stream, as measured on a map, aerial photograph or other horizontal plane. Also called catchment area, watershed, and basin.

WATERSHED MANAGEMENT AREA (WMA): In the context of the North Coast Regional Water Quality Control Board's Watershed Management Initiative, this represents a grouping of smaller watersheds into a larger area for identifying and addressing water quality problems, e.g., the Humboldt WMA includes all watersheds draining to the ocean or bays north of the Eel River to and including Redwood Creek.

WEIR: A barrier constructed across a stream to divert fish into a trap.

WETLAND: An area subjected to periodic inundation, usually with soil and vegetative characteristics that separate it from adjoining non-inundated areas.

WILDLIFE CORRIDOR: Linear spaces that connect the various areas of an animal's habitat, links between feeding, watering, resting, and breeding places.

List of Abbreviations

BLM	Bureau of Land Management
CalEPA	California Environmental Protection Agency
Caltrans	California Department of Transportation
CCD	Census County Division
CDF	California Department of Forestry and Fire Protection
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFS	Cubic Feet per Second
DAU	Detailed Analysis Unit
DFG	California Department of Fish and Game
DOC/DMG	California Department of Conservation-Division of Mines and Geology
DWR	California Department of Water Resources
EMDS	Ecological Management Decision Support
EPA	Environmental Protection Agency
EPIC	Environmental Protection Information Center
ESA	Federal Endangered Species Act
ESU	Evolutionarily Significant Units
FPA	Z'Berg-Nejedly Forest Practice Act
FPR	California Forest Practice Rules
GIS	Geographic Information System
HA	Hydrologic Area
HCP	Habitat Conservation Plan
HR	North Coast Hydrologic Region
HSA	Hydrologic Sub-area
HU	Hydrologic Unit
IFR	Institute for Fisheries Resources
KRIS	Klamath Resource Information System
KRNCA	King Range National Conservation Area
LFA	Limiting Factor Analysis

LWD	Large Woody Debris
MOU	Memorandum of Understanding
MRC	Mattole Restoration Council
MSG	Mattole Salmon Group
MTJ	Mendocino Triple Junction
MWAT	Maximum Weekly Average Temperature
NCWAP	North Coast Watershed Assessment Program
NEPA	National Environmental Policy Act
NPDES	National Pollution Discharge Elimination System
NMFS	National Marine Fisheries Service
PSA	Planning Sub Area
PWS	Planning Watershed
RM	River Mile
RWQCB	North Coast Regional Water Quality Control Board
SPWS	Super Planning Watershed
SRP	Scientific Review Panel
SWRCB	California State Water Resources Control Board
TMDL	Total Maximum Daily Load
TPZ	Timber Production Zone
USFS	United States Forest Service
USGS	United States Geologic Survey
WMA	Watershed Management Area
WQO	Water Quality Objectives